

Specification for TFT

AFY480272A0-4.3INTH-C

Revision F



A	Orient Display
FY	TFT Type
480272	Resolution 480 x 272
A0	Serial A0
4.3	4.3", Module Dimension 105.50 x 67.20 x 4.85 mm
I	IPS Display
N	Top: -20~+70°C; Tstr: -30~+80°C
T	Transmissive
H	High Brightness, 900 cd/m2
C	Capacitive Touch Panel
/	Controller SC7283-G4 Or Compatible
/	CTP Controller GT911 Or Compatible
/	RGB 24bit Interface



REVISION RECORD

[illegible]

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1. GENERAL INFORMATION

No.	Item	Contents	Unit
1	LCD size	4.3 inch (Diagonal)	/
2	Display mode	IPS/Normally black/Transmissive	/
3	Viewing direction(eye)	Free	/
4	Gray scale inversion direction	-	/
5	Resolution(H*V)	480*272Pixels(TFT)/ 480*272Dots(CTP)	/
6	Module size (L*W*H)	105.50*67.20*4.85	mm
7	Active area (L*W)	95.04*53.86	mm
8	Pixel pitch (L*W)	0.198*0.198	mm
9	Interface type	RGB 24bit interface	/
10	Color Depth	16.7M	/
11	Module power consumption	0.852	W
12	Back light type	White LED	/
13	Driver IC	SC7283-G4 OR COMPATIBLE(TFT) GT911(CTP)	/
14	Weight	TBD	G

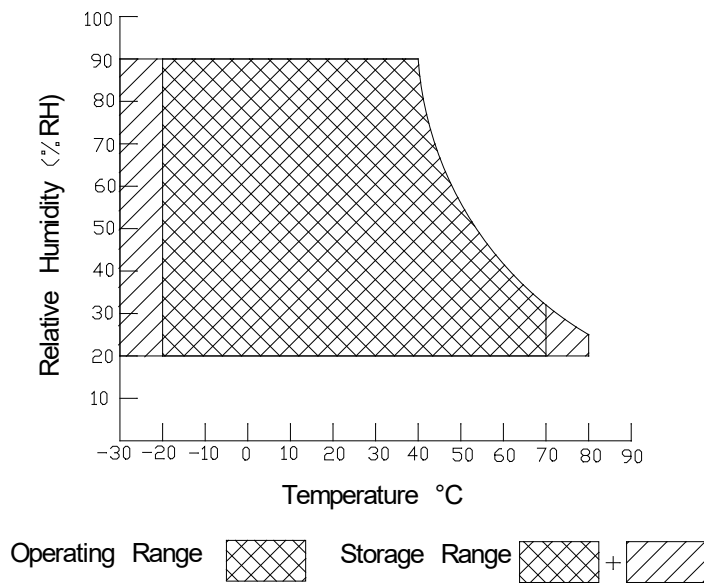
2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Power supply input voltage for TFT	VDD	-0.3	5.0	V	
Backlight current (normal temp.)	ILED	-	50	mA	
Operation temperature	Top	-20	+70	°C	Note1
Storage temperature	Tst	-30	+80	°C	Note1
Humidity	RH	-	90%	RH	Note1

Note1 :

1).The relative humidity and temperature range are as below sketch,90%RH Max.

2).The maximum wet bulb temperature $\leq 40^{\circ}\text{C}$ and without dewing.



3. ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS(at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply input voltage	VDD	2.8	3.3	3.6	V	
I/O logic voltage	VDDIO	3.0	-	3.6	V	
Input voltage 'H' level	VIH	0.7VDDIO	-	VDDIO	V	
Input voltage 'L' level	VIL	VSS	-	0.3VDDIO	V	
Power supply current	IVDD	-	40	-	mA	
TFT gate on voltage	VGH	-	-	-	V	
TFT gate off voltage	VGL	-	-	-	V	
Analog power supply voltage	AVDD	-	-	-	V	
Differential input common mode voltage	Vcom	-	-	-	V	Note1

Note1 : The value is just the reference value. The customer can optimize the setting value by the different D-IC

Vcom must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc..

CTP DC CHARACTERISTICS(at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply input voltage	VCC	2.66	3.3	3.47	V	Note2
Input Power ripple	Vpp	-	-	50	mV	
I/O Signal Voltage	VCCIO	-	VCC	-	V	Note2
Input voltage 'H' level	VIH	0.75VCCIO	-	VCCIO	V	
Input voltage 'L' level	VIL	VSS	-	0.25VCCIO	V	
Operating Current (Normal Mode)	IVCC	-	-	-	mA	
Operating Current (Sleep mode)	IVCC	-	-	-	mA	

Note2 : If you need more information of CTP, please refer to our Spec of CTP.

4. BACKLIGHT CHARACTERISTICS

(at Ta=25°C, RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED forward voltage	VF	16.8	18.0	19.2	V	
LED forward current	IF	-	40	-	mA	IF=20*2mA
LED power consumption	PLED	-	0.72	-	W	Note1
Number of LED	-		12		PCS	
Connection mode	-	6 in series 2 in parallel			/	
LED life-time	-	-	50000	-	Hrs	Note2

Note1 : Calculator value for reference : IF*VF = PLED

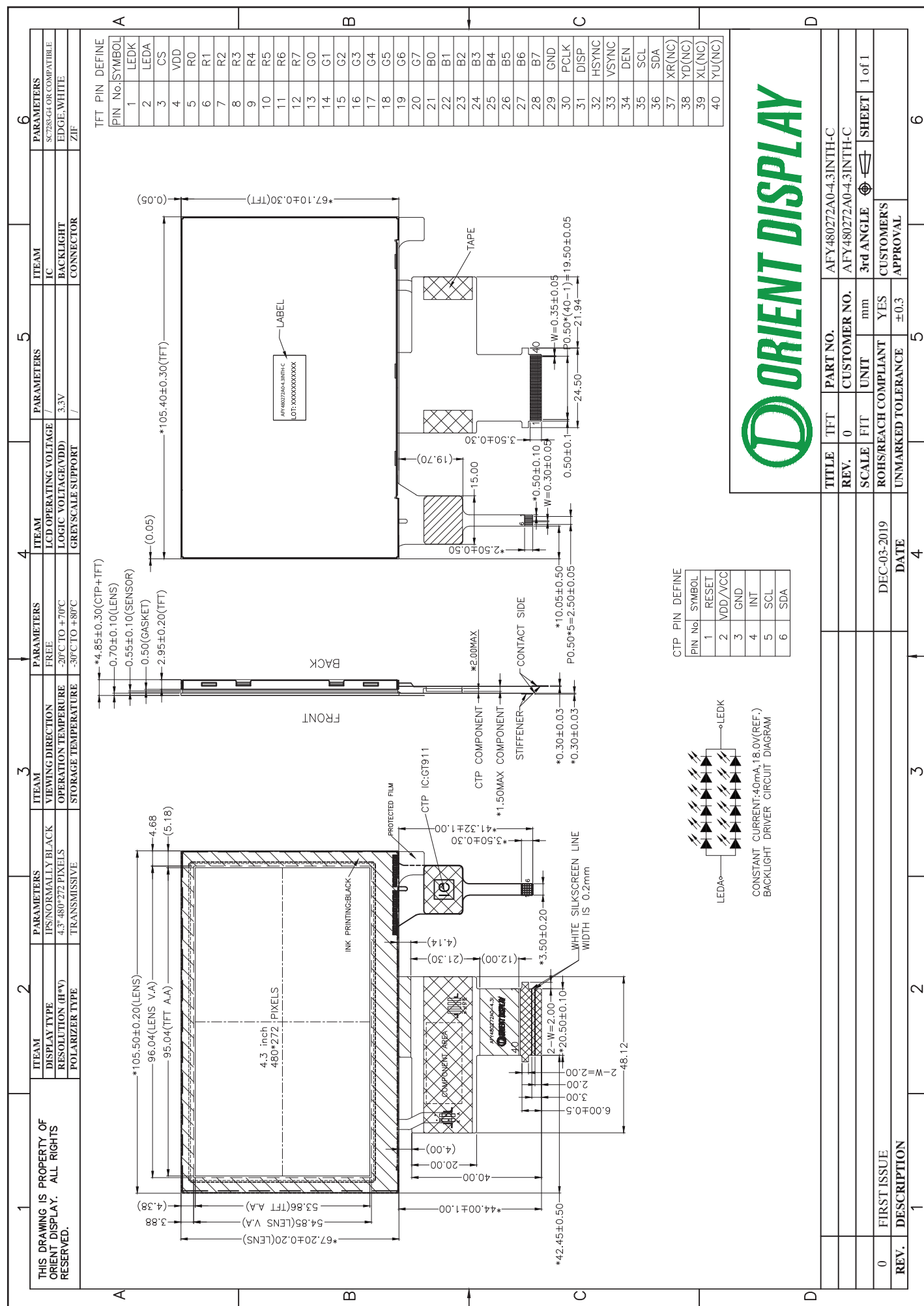
Note2 : The LED life-time define as the estimated time to 50% degradation of initial brightness at Ta=25°C and IF =40mA. The LED lifetime could be decreased if operating IF is larger than 40mA.

5. TOUCH PANEL CHARACTERISTICS

(at Ta=25°C)

Item	Description	Remark
Product Structure	G+G	
Surface Hardness	≤6H	Pencil, Loading 500g, 45 deg
Ball-falling Test	≤60cm	Steel ball weight 64g
Touch Count Max	5 point	
I2C Slave Address*	0x5D	
Origin of Coordinate*	Top left corner	
FW version	0x00	

6. EXTERNAL DIMENSIONS



7. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	40	ms	FIG.1	Note 1
Contrast ratio	Cr		640	800	-	-	FIG.2	Note 2
Surface luminance	Lv	$\theta=0^\circ$	600	900	-	cd/m ²	FIG.2	Note 3
Luminance uniformity	Yu	$\theta=0^\circ$	75	80	-	%	FIG.2	Note 4
NTSC	-	$\theta=0^\circ$	-	50	-	%	FIG.2	Note 5
Viewing angle	θ	$\phi=90^\circ$	70	80	-	deg	FIG.3	Note 6
		$\phi=270^\circ$	70	80	-	deg	FIG.3	
		$\phi=0^\circ$	70	80	-	deg	FIG.3	
		$\phi=180^\circ$	70	80	-	deg	FIG.3	
CIE (x,y) chromaticity	Red x	$\theta=0^\circ$ $\phi=0^\circ$ Ta=25°C	Typ -0.04	0.60	Typ +0.04	-	FIG.2 CIE1931	Note 5
	Red y			0.35		-		
	Green x			0.36		-		
	Green y			0.59		-		
	Blue x			0.15		-		
	Blue y			0.13		-		
	White x			0.33		-		
	White y			0.38		-		

Note1. Definition of response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%. For additional information see FIG1.

Note2. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula.
For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Measured at the center area of the LCD

Note3. Definition of surface luminance

Surface luminance is the luminance with all pixels displaying white.
For more information see FIG.2.

$$Lv = \text{Average Surface Luminance with all white pixels}(P1, P2, P3, \dots, Pn)$$

Note4. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG. 2.

$$Yu = \frac{\text{Minimum surface luminance with all white pixels } (P1, P2, P3, \dots, Pn)}{\text{Maximum surface luminance with all white pixels } (P1, P2, P3, \dots, Pn)}$$

Note5. Definition of color chromaticity (CIE1931)

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.
For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope or DMS series Instruments or compatible. For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is base on TOPCON's BM-5or BM-7 photo detector or compatible.

FIG.1. The definition of response Time

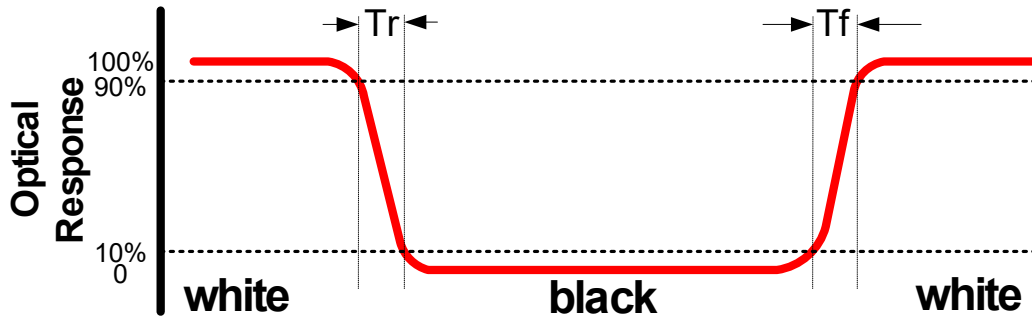


FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity

H,V : Active area

Light spot size $\varnothing=5\text{mm}$ (BM-5) or $\varnothing=7.7\text{mm}$ (BM-7)50cm distance or compatible distance from the LCM surface to detector lens.

Test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible ,see Figure b.

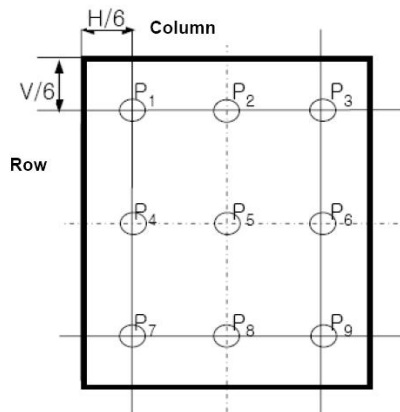


Figure a

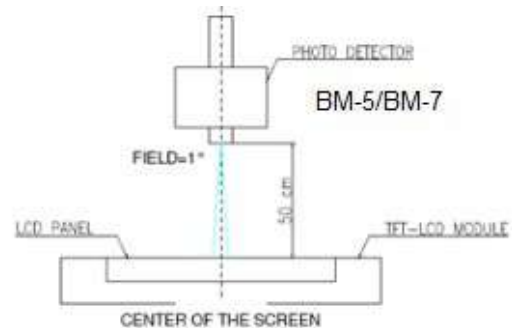
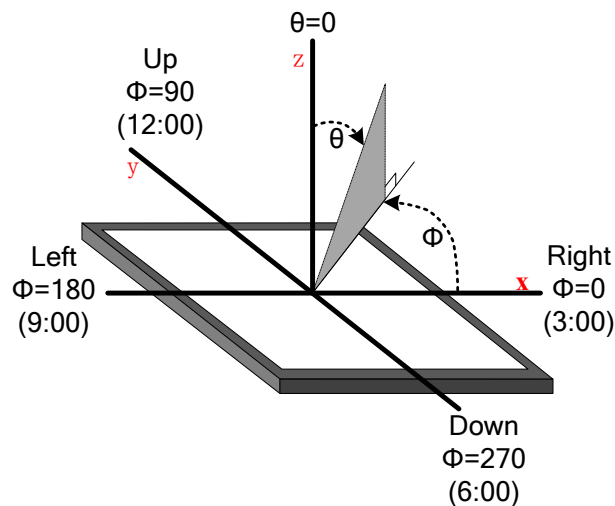


Figure b

FIG.3. The definition of viewing angle



8. INTERFACE DESCRIPTION

8.1Module Interface description

Interface No.	Name	I/O or connect to	Description
1	LEDK	P	Power for LED backlight(Cathode)
2	LEDA	P	Power for LED backlight(Anode)
3	CS	I	Chip Selected signal When CS=0,the chip is enable.
4	VDD	P	Power for LCD
5-12	R0-R7	I	Red data Bus
13-20	G0-G7	I	Green data Bus
21-28	B0-B7	I	Blue data Bus
29	GND	P	Ground
30	DCLK	I	Dot clock
31	DISP	I	Set display mode. DISP=0:Standby mode. DISP=1:Normal display mode.
32	HSYNC	I	Horizontal sync input.
33	VSYNC	I	Vertical sync input
34	DE	I	Data enable
35	SCL	I	Serial Clock input Signal
36	SDA	I/O	Serial Data input Signal
37	XR(NC)	/	No Connection, the pin float
38	YD(NC)	/	No Connection, the pin float
39	XL(NC)	/	No Connection, the pin float
40	YU(NC)	/	No Connection, the pin float

8.2CTP Interface description

Interface No.	Symbol	I/O or connect to	Description
1	RESET	I	Reset Pin, Reset="low" Active.
2	VDD/VCC	P	CTP Power Supply
3	GND	P	CTP Ground.
4	INT	I	State change interrupt Signal.
5	SCL	I	I2C Serial O'clock input signal
6	SDA	I/O	I2C Serial data Input signal.

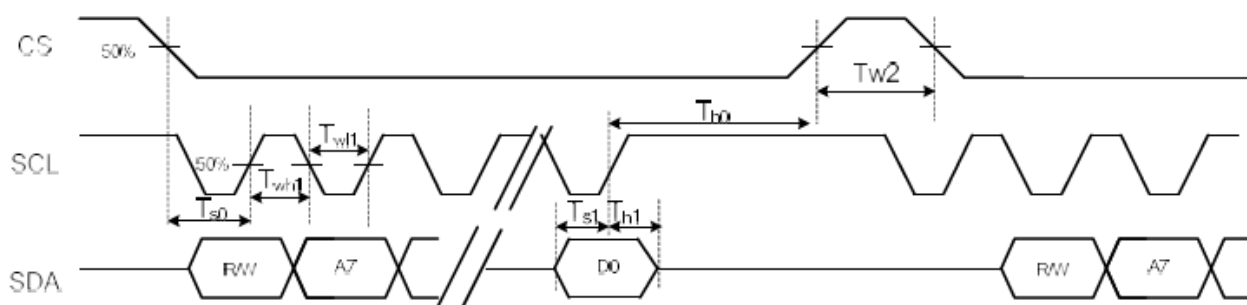
9. AC CHARACTERISTICS

AC Electrical Characteristics (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C, Bare Chip)

9.1 System Operation AC Characteristics

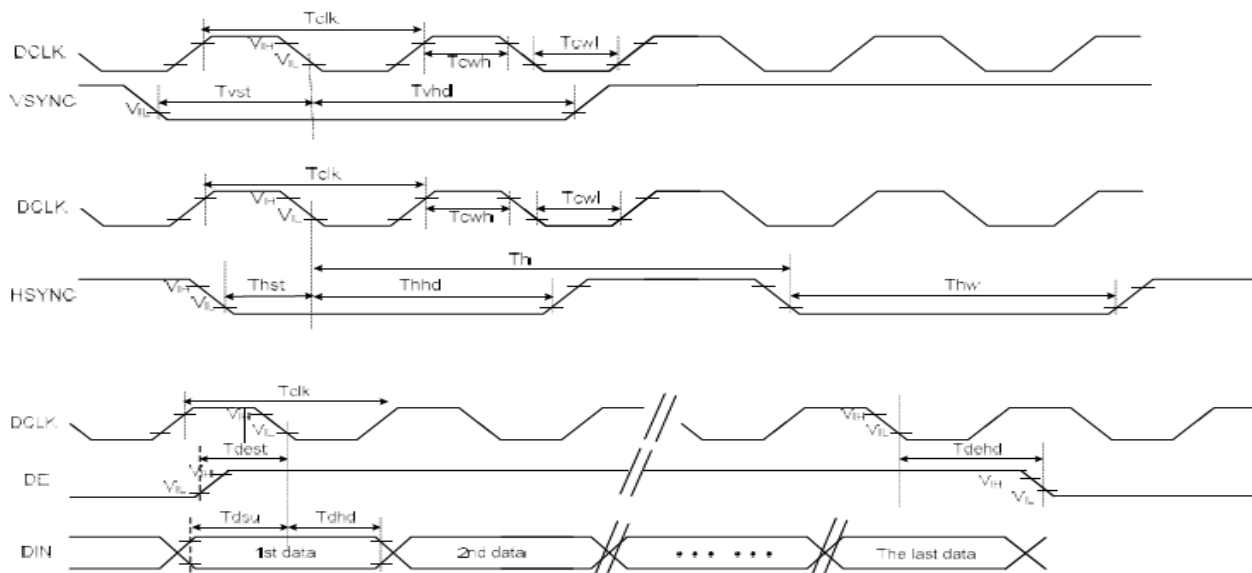
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power Source Slew Time	TPOR	-	-	20	ms	From 0V to 99% VDD
GRB Pulse Width	tRSTW	10	50	-	us	R=10Kohm, C=1uF
SD Output Stable Time	Tst	-	-	12	us	Output settled within +20mV Loading = 6.8k+28.2pF.
GD Output Rise and Fall Time	Tgst	-	-	6	us	Output settled (5%~95%), Loading = 4.7k+29.8pF

9.2 System Bus Timing for SPI-3 Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CS Input Setup Time	Ts0	50	-	-	ns	
Serial Data Input Setup Time	Ts1	50	-	-	ns	
CS Input Hold Time	Th0	50	-	-	ns	
Serial Data Input Hold Time	Th1	50	-	-	ns	
SCL Write Pulse High Width	Twh1	50	-	-	ns	
SCL Write Pulse Low Width	Twl1	50	-	-	ns	
SCL Read Pulse High Width	Trh1	300	-	-	ns	
SCL Read Pulse Low Width	Trl1	300	-	-	ns	
CS Pulse High Width	Tw2	400	-	-	ns	

9.3 System Bus Timing for RGB Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tcw	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	

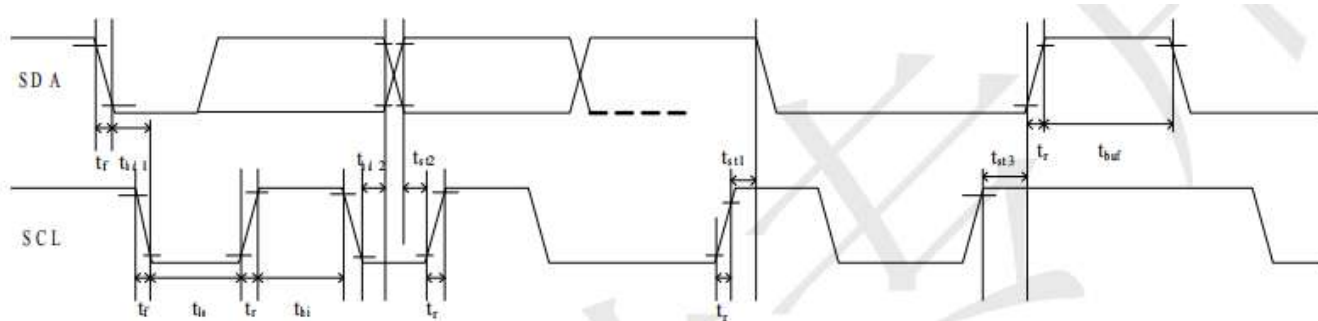
Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

480RGB X 272 Resolution Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	
DCLK Period		Tclk	83	111	125	ns	
HSYNC	Period Time	Th	485	531	598	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	276	292	321	HSYNC	
	Display Period	Tvdisp		272		HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	By V_BLANKING setting
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

Note: It is necessary to keep $T_{vbp} = 12$ and $T_{hbp} = 43$ in sync mode. DE mode is unnecessary to keep it.

9.4 I2C Communication

GT911 provides a standard I2C interface for SCL and SDA to communicate with the host. GT911 always serves as slave device in the system with all communication being initialized by the host. It is strongly recommended that transmission rate be kept at or below 400Kbps. The I2C timing is shown below:



Test condition 1: 1.8V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor

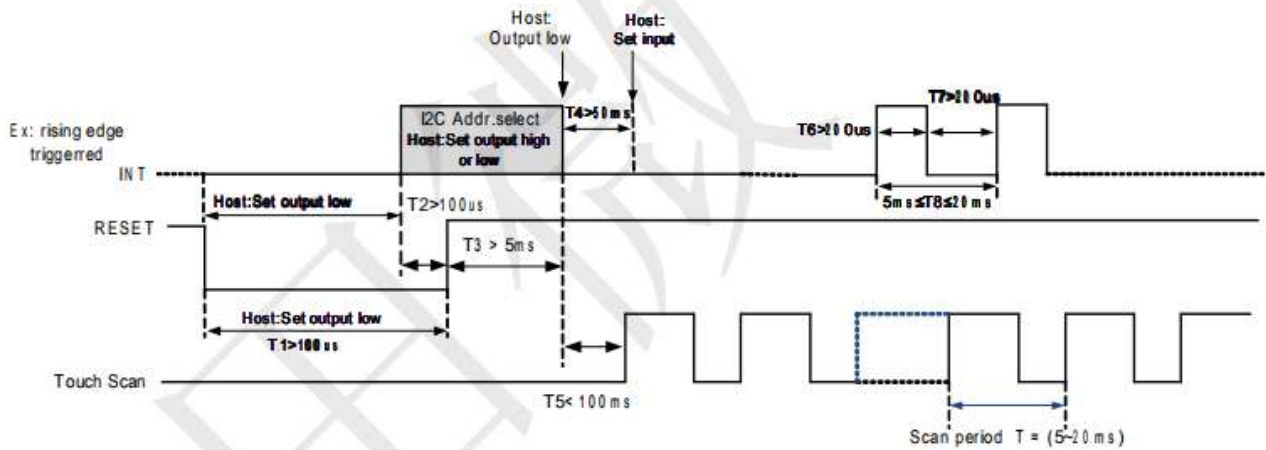
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	US
SCL high period	t_{hi}	0.6	-	US
SCL setup time for Start condition	t_{st1}	0.6	-	US
SCL setup time for Stop condition	t_{st3}	0.6	-	US
SCL hold time for Start condition	t_{hd1}	0.6	-	US
SDA setup time	t_{st2}	0.1	-	US
SDA hold time	t_{hd2}	0	-	US

Test condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor

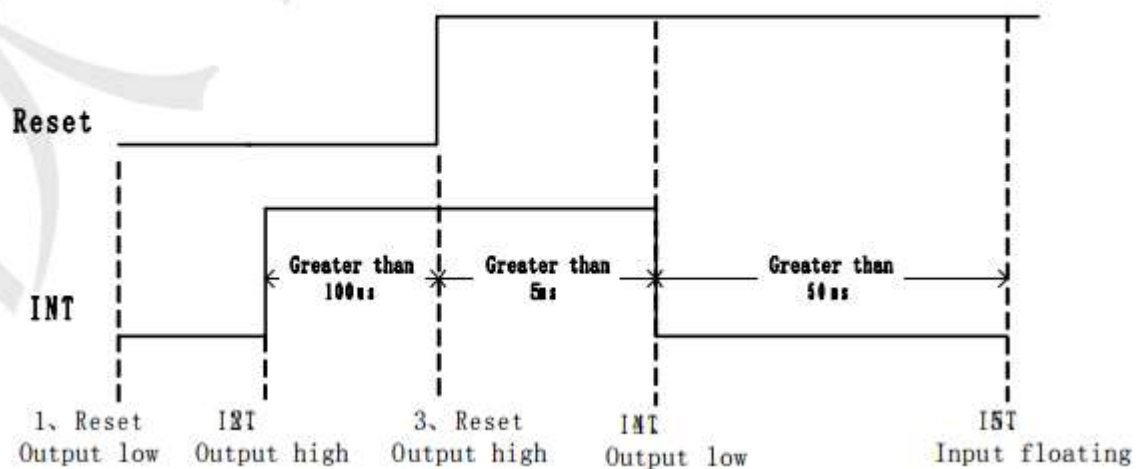
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	US
SCL high period	t_{hi}	0.6	-	US
SCL setup time for Start condition	t_{st1}	0.6	-	US
SCL setup time for Stop condition	t_{st3}	0.6	-	US
SCL hold time for Start condition	t_{hd1}	0.6	-	US
SDA setup time	t_{st2}	0.1	-	US
SDA hold time	t_{hd2}	0	-	US

GT911 supports two I2C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the address by changing the status of Reset and INT pins during the power-on initialization phase. See the diagram below for configuration methods and timings:

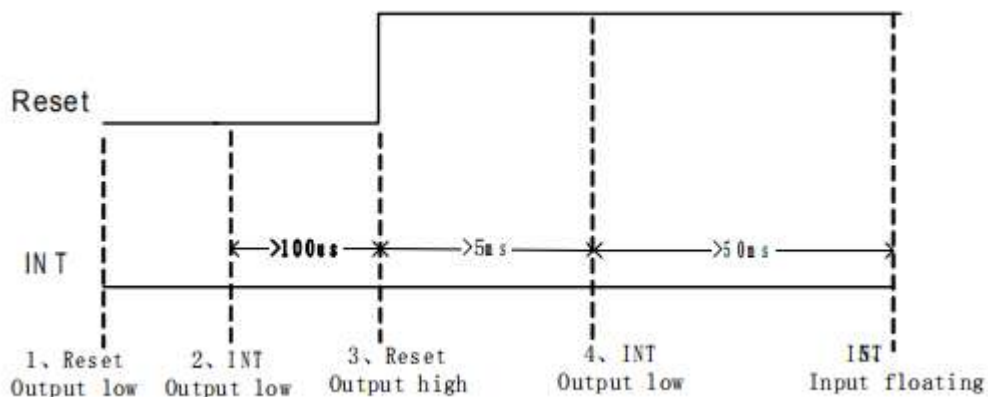
Timing for host resetting GT911:



Timing for setting slave address to 0x28/0x29:



Timing for setting slave address to 0xBA/0xBB:



a) Data Transmission

(For example: device address is 0xBA/0xBB)

Communication is always initiated by the host. Valid Start condition is signaled by pulling SDA line from "high" to low " when SCL line is high ". Data flow or address is transmitted after the Start condition.

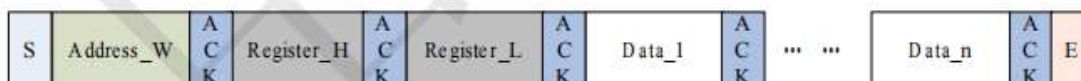
All slave devices connected to I²C bus should detect the 8-bit address issued after Start condition and send the correct ACK. After receiving matching address, GT911 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving unmatched address, namely, not 0xBA or 0xBB, GT911 will stay in an idle state.

For data bytes on SDA, each of 9 serial bits will be sent on nine SCL cycles. Each data byte consists of 8 valid data bits and one ACK or NACK bit sent by the recipient. The data transmission is valid when SCL line is "high"

When communication is completed, the host will issue the STOP condition. Stop condition implies the transition of SDA line from "low" to "high" when SCL line is "high"

b) Writing Data to GT911

(For example: device address is 0xBA/0xBB)



Timing for Write Operation

The diagram above displays the timing sequence of the host writing data onto GT911. First, the host issues a Start condition. Then, the host sends 0xBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

After receiving ACK, the host sends the 16-bit register address (where writing starts) and the 8-bit data bytes (to be written onto the register).

The location of the register address pointer will automatically add 1 after every Write Operation. Therefore, when the host needs to perform Write Operations on a group of registers of continuous addresses, it is able to write continuously. The Write Operation is terminated when the host issues the Stop condition.

c) Reading Data from GT911

(For example: device address is 0xBA/0xBB)



Timing for Read Operation

The diagram above is the timing sequence of the host reading data from GT911. First, the host issues a Start condition and sends 0xBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

After receiving ACK, the host sends the 16-bit register address (where reading starts) to the slave device. Then the host sets register addresses which need to be read.

Also after receiving ACK, the host issues the Start condition once again and sends 0xBB (Read Operation). After receiving ACK, the host starts to read data.

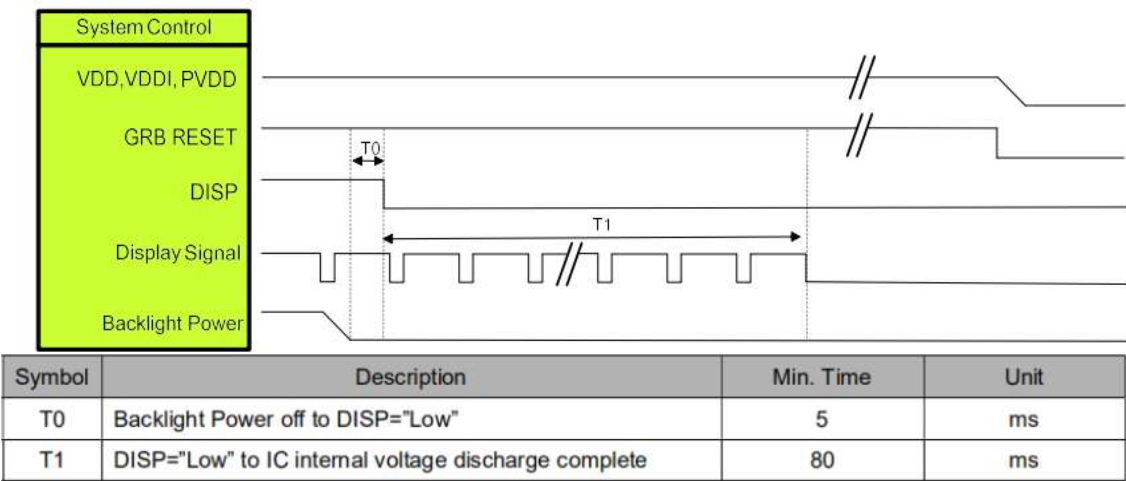
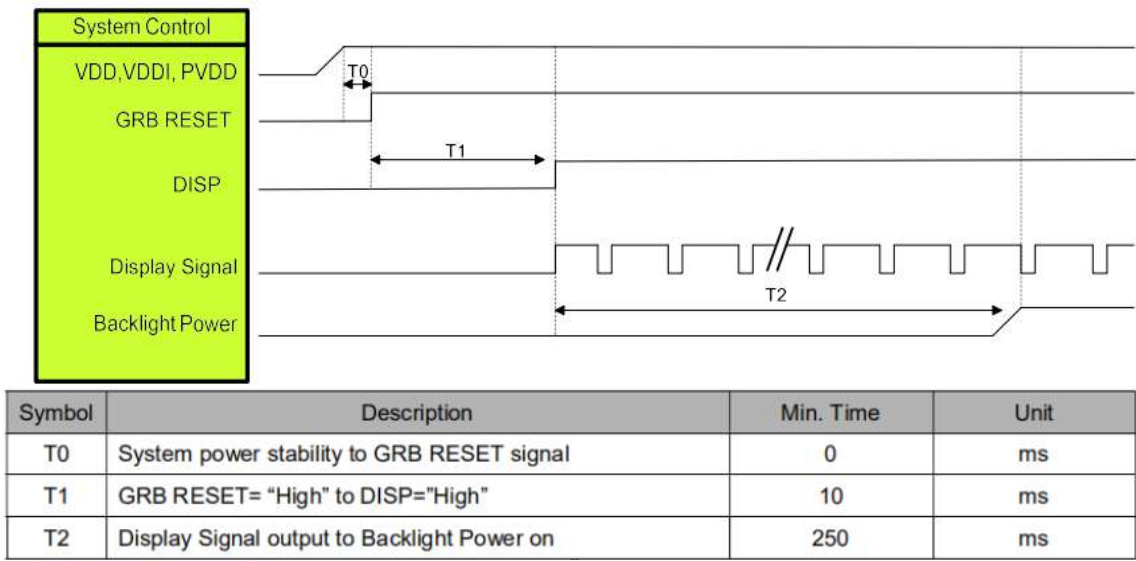
GT911 also supports continuous Read Operation and, by default, reads data continuously. Whenever receiving a byte of data, the host sends an ACK signal indicating successful reception. After receiving the last byte of data, the host sends a NACK signal followed by a STOP condition which terminates communication.

10. POWER SEQUENCE

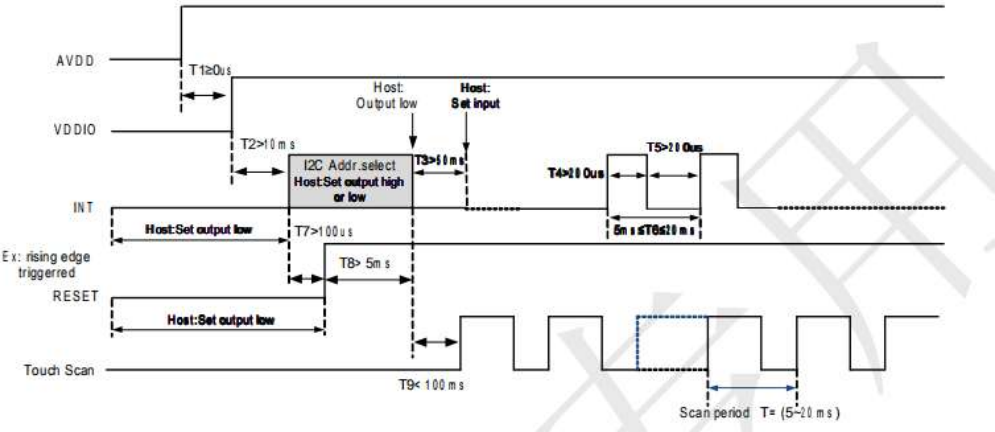
TFT Module POWER SEQUENCE

To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.
Power ON: VDD, DGND→VDDA; Power OFF:AGND→VDD, DGND

In order to prevent SC7283-G4 from power ON reset fail, the rising time (tPOR) of the digital power supply VDD should be maintained within given specifications. The power ON/OFF timing sequence is illustrated as below:



CTP POWER SEQUENCE(Ignored,if you need to understand it and we can provide expatiation for you.)



11. RELIABILITY TEST CONDITIONS

No.	Test item	Test condition		Inspection after test
11.1	High temperature storage test	+80°C/240 hours		Inspection after 2~4hours storage at room temperature, the sample shall be free from defects : 1.Current changing value before test and after test is 50% larger; 2. Function defect : Non-display,abnormal-d isplay,missing lines, Short lines,ITO corrosion; 3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack.
11.2	Low temperature storage test	-30°C/240 hours		
11.3	High temperature operating test	+70°C/120 hours		
11.4	Low temperature operating test	-20°C/120 hours		
11.5	Temperature cycle storage test	-30°C ~ 25°C ~ +80°C/10cycles (30min.) (10min.) (30min.)		
11.6	High temperature high humidity test	+50°C*90% RH/120 hours		
11.7	Vibration test	Frequency : 250 r/min Amplitude : 1 inch Time: 45min		
11.8	Drop test	Drop direction: 1 corner/3 edges/6 sides 10 time		
		Packing weight(kg)	Drop height(cm)	
		<11	80±1.6	
		11≤G<21	60±1.2	
		21≤G<31	50±1.0	
		31≤G<40	40±0.8	
11.9	ESD test	Air discharge: ±8KV, 10time Contact discharge: ±4KV, 10time		
Remark : 1.The test samples should be applied to only one test item. 2.Sample size for each test item is 3~5pcs. 3.For High temperature high humidity test, Pure water(Resistance>10MΩ) should be used. 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part. 5.B/L evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence B/L has. 6.Failure judgment criterion: Basic specification, Electrical characteristic, Mechanical characteristic, Optical characteristic. 7.After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.				

12. INSPECTION CRITERION

Refer to the quality standard on the back of the specification

13. HANDLING PRECAUTIONS

13.1 Mounting method

The LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

13.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[recommended below] and wipe lightly :

- .Isopropyl alcohol
- .Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- .Water
- .Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated :

- .Soldering flux
- .Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

13.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you :

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

13.4 Packing

Module employs LCD elements and must be treated as such.

- .Avoid intense shock and falls from a height.
- .To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

13.5 Caution for operation

- .It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- .An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- .Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- .If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- .A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
- .Usage under the maximum operating temperature, 50%Rh or less is required.
- .When fixed patterns are displayed for a long time, remnant image is likely to occur.

13.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose of replacement use, the following ways are recommended.

- .Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.
- .Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- .Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- .Storing with no touch on polarizer surface by anything else.

It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

13.7 Safety

- .It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

- .When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

14. PRECAUTION FOR USE

14.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

14.2 On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- .When a question is arisen in this specification.
- .When a new problem is arisen which is not specified in this specifications.
- .When an inspection specifications change or operating condition change in customer is reported to ODNA, and some problem is arisen in this specification due to the change.
- .When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

15. PACKING SPECIFICATION

Please consult our technical department for detail information.

16.HSF COMPLIANCE

- .This products complies with ROHS 2011/65/EU and 2015/863/EU、REACH 1907/2006/EC requirements, and the packaging complies with 94-62-EC.